from which $B^2=.918904$ and $B=.9586$. Substituting the value of B^2 in the expression for DF, $DF=OO'=8.5432$. Then $DE=OO'-2B=6.626$, and $EK=\sqrt{[(30)^2+(2)^2-(6.626)^2]}=29.3274$ feet, or 29 feet 3.9288 inches, the length of car required.

Also solved by the late *P. H. PHILBRICK*, who obtained as a result, 29.168 feet.

CALCULUS.

155. Proposed by F. P. MATZ. Sc. D., Ph. D., Professor of Mathematics and Astronomy in Defiance College Defiance, Ohio.

Solve the differential equations:

$$(A).\quad \frac{d^4y}{dx^4}+2\frac{d^2y}{dx^2}=\sin 2x+\sin x-x. \qquad (B).\quad \frac{d^2y}{dx^2}+2\frac{dy}{dx}=\sin 2x+\sin x-x.$$

Solution by CHRISTIAN HORNUNG, A. M., Heidelberg University, Tiffin, O., and LON C. WALKER, A. M., Leland Stanford University.

Using the symbolic method (A) becomes $(D^4+2D^2)y=\sin 2x+\sin x-x$. The complementary function is $c_1+c_2x+c_3\cos\sqrt{2}x+c_4\sin\sqrt{2}x$, and the particular integral

$$=\frac{1}{D^2(D^2+2)}(\sin 2x+\sin x-x)=\frac{1}{D^2}\cdot\frac{1}{D^2+2}\sin 2x+\frac{1}{D^2}\cdot\frac{1}{D^2+2}\sin x-$$

$$\frac{1}{D^2+2}\cdot\frac{1}{D^2}x=\tfrac{1}{8}\sin 2x-\sin x-(2+D^2)^{-1}.\frac{x^3}{6}=\tfrac{1}{8}\sin 2x-\sin x-\frac{x^3}{12}+\tfrac{1}{4}x.$$

$\therefore\ y=c_1+c_2x+c_3\cos\sqrt{2}x+c_4\sin\sqrt{2}x+\frac{1}{8}\sin 2x-\sin x-\frac{1}{12}x^3$ ($\frac{1}{4}x$ being included in c_2x); and (B) becomes $(D^2+2D)y=\sin 2x+\sin x-x$.

$\therefore$ The complementary function is $c_1+c_2e^{-2x}$, and the particular integral

$$=\frac{1}{D^2+2D}(\sin 2x+\sin x-x)=\frac{1}{D^2+2D}\sin 2x+\frac{1}{D^2+2D}\sin x-\frac{1}{D+2}\cdot\frac{1}{D}x$$

$$=\frac{1}{2D-4}\sin 2x+\frac{1}{2D-1}\sin x-(2+D)^{-1}.\tfrac{1}{2}x^2$$

$$=\tfrac{1}{2}.\frac{D+2}{D^2-4}\sin 2x+\frac{2D+1}{4D^2-1}\sin x-(\tfrac{1}{2}-\tfrac{1}{4}D+\tfrac{1}{8}D^2)\tfrac{1}{2}x^2$$

$$=-\tfrac{1}{16}(D+2)\sin 2x-\tfrac{1}{5}(2D+1)\sin x-\tfrac{1}{4}x^2+\tfrac{1}{4}x-\tfrac{1}{8}$$

$$=-\tfrac{1}{8}\cos 2x-\tfrac{1}{8}\sin 2x-\tfrac{2}{5}\cos x-\tfrac{1}{5}\sin x-\tfrac{1}{4}x^2+\tfrac{1}{4}x-\tfrac{1}{8}.$$

$\therefore\ y=c_1+c_2e^{-2x}-\frac{1}{8}(\cos 2x+\sin 2x)-\frac{2}{5}\cos x-\frac{1}{5}\sin x-\frac{1}{4}x^2+\frac{1}{4}x$, ($-\frac{1}{8}$ being included in the term c_1).

Also solved by *J. SCHEFFER*, *W. W. LANDIS*, *G. W. GREENWOOD*, and *WILLIAM HOOVER*.